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The chemical composition of food preservatives. Solutions for testing cream and milk.

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The Chemical Composition of Food Preservatives.

J. B. WEEMS. I. J. MEAD.

There are many substances which are found on the market at the present time intended for preserving food products under various brands and names. The claims made for these substances by the manufacturers would lead one to believe that the brand of substance for which the claim is made possessed a wonderful power for preserving food products. When these mixtures are examined it is found that they are composed of common substances and such that any one could readily prepare for a small part of the price charged for them.

The Chemical Section has been making a collection of these substances for sometime past, and a number have been analyzed.

The Preservaline Manufacturing Company produces a number of the mixtures for which great claims are made for their wonderful preserving power. Some of the brands produced by this firm are as follows:

A brand called "A" which is intended for preserving meat, poultry, game, etc., is sold for 30 cents per pound and 25 cents for 5 and 50 lb boxes. This substance was found to consist of 34 per cent of salt and 66 per cent of borax. The Connecticut Experiment Station found that a sample of the same brand was composed of 32 per cent of salt and 68 per cent of borax. For using this substance the directions are as follows:

"Pork and Liver Sausage, Sausage Meat, Chopped Meat.—Use 1 lb. of "A" Preservaline over the meat, while being chopped and mixed. Salt and spices are added as usual. The "A" preservaline works like a charm, keeping the meat perfectly sweet and moist, and retains the natural color."

The brand "BB" is used for another mixture which is advertised for preserving butter and cheese. This substance consists of a mixture of 25 per cent of common salt and 75 per cent of a mixture of borax and boric acid. The substance is sold for 30 cents per lb. and at 25 cents in 5 to 50 lb. packages. The directions for preserving butter and cheese are as follows:

"Quantities of "BB" Preservaline to be used.—To hold butter in its fine natural and rich flavor for six (6) months use (1) one pound of "BB" Preservaline for every 100 lbs. of butter, if made in the spring or summer. If made in the late fall and winter use three-quarters (¾) pounds of "BB" Preservaline to every 100 pounds of butter."

"Cheese.—To preserve the flavor and quality of Full Cream Cheese put two ounces of "BB" Preservaline to each 2½ or 3 lbs. of salt and mix well, then use 2½ or 3 lbs. of this mixture to 100 lbs. of Dry Curd. In working skim-milk into cheese, use 4 ounces of "BB" Preservaline to 100 lbs. of cheese to be made. Pot Cheese, Baker's Cheese, Cream Cheese, Smear Kaese, Neufchatel Cheese, etc., can all be kept in the most perfect condition by mixing at the rate of 6 ounces of "BB" Preservaline to 100 lbs. of cheese."

For preserving milk the brand "M" is prepared by the Preservaline Manufacturing Co. and consists of a mixture of 20 per cent of borax and 80 per cent of boric acid. The price at which this mixture is sold is for single pounds 35 cents and in 5 lb., 10 lb., and 25 lb. boxes at 32 cents, and in 100 lbs. and in barrels at 30 cents. The directions for using this product are as follows:

FOR USING "M" PRESERVALINE IN MILK.

To keep milk for 36 hours use 1 ounce "M" Preservaline.
" " " " 48 " " 2 " " "
" " " " 3 to 4 days use 3 oz. " "
" " " " a week use 5 oz. "M" Preservaline.

The same company have a brand called "Butter Powder" for which the following claim is made:

"Preservaline Butter Powder is especially useful where butter is made on a comparatively small scale, on farms and in small dairies. It brings the butter quickly—generally in from ten to twenty minutes—and is indispensable in the making of good, fresh butter at all seasons of the year. It produces a firm butter, one that will not turn soft so quickly in hot weather, and, if used in connection with "BB" Preservaline will prevent the butter turning rancid. It imparts a richness, flavor and sweetness to butter unobtainable by any other means. Removes all unpleasant taste caused by the cows eating weeds

and other strong food. When Preservaline Butter Powder is used, the butter milk will be sweet and fit for use.

Preservaline Butter Powder contains nothing in any way harmful; it is guaranteed pure and wholesome."

The result of the analysis shows that the substance is ordinary bread soda selling at the grocery store for from 5 to 10 cents per pound. The charge for the soda in the boxes sold under the name of "Butter Powder" is 50 cents. The analysis of this "Butter Powder" by the Connecticut Experiment Station also showed that it is ordinary bread or baking soda.

It is readily seen from the analysis that there is quite a profit in placing bread soda in boxes and selling it under the name of "Butter Powder."

"FF" is the brand under which a mixture is sold for preserving fish, clams, etc., for which it is said:

"Fresh Fish, Lobsters, Oysters, Clams, Scallops, etc., can be kept sweet and perfectly sound for a long time without using ice, by merely placing them in a solution of Preservaline, made at the rate of 1½ pounds of "FF" Preservaline to 1 gallon of water."

This substance consists of a mixture of 25 per cent of common salt, 50 per cent of borax and 25 per cent of boric acid, and is sold at 30 cents per pound; 25 cents per pound in 5 to 50 lb. boxes; in kegs and barrels at 20 cents per pound.

Freezine is a preparation which is placed upon the market by B. Heller & Co., Chicago. The claims made for this substance as a preservative are taken from circulars of this firm and are as follows:

"Freezine does not lessen the value of the milk, but increases the value by adding to its keeping properties and by rendering it healthful to the human system. Directly after Freezine is used it evaporates and entirely disappears from the milk; no chemical analysis can prove its presence in the milk, quantitatively or otherwise. Freezine puts the germs in a state of torpor from which they can not be resuscitated by warmth of the milk, the atmosphere or the stomach. Freezine is not a germicide; it does not kill the germs. It only places the germs in a state of torpidity, so they can be digested without harmful effects; it is therefore an anesthetic for germ life. Freezine is a vegetable composition and contains no deleterious

substances whatever. It is the only preparation manufactured that will not change the natural sweet flavor of milk, buttermilk or cream, but will keep them perfectly sweet and in a fresh condition for a week, if necessary, without the use of ice or cold storage. Remember it does not remain in the milk, but quickly evaporates, therefore it cannot be an adulterant in the language or spirit of the law. As chemists with many years' experience, we are well qualified to make positive statements covering all these points."

In addition to the above claim made for the substance the following statement may be of interest. "Freezine is *perfectly harmless* and is not injurious to the human system, as it freezes the Bacteria and evaporates quickly, leaving the milk in a perfectly healthful condition. It is *much cheaper* to use Freezine than ice, and is less work."

These statements would naturally mislead many regarding the substance and one would be surprised by way of contrast with the claims made by the manufacturers of "Freezine" to read the testimony of Mr. Heller, as given before the committee for food adulteration of the Senate. In this testimony it is stated that freezine is a 6 per cent solution of formaldehyde and that the manuacturers "compound" the substance by mixing the formaldehyde with water.

The analysis of Freezine at the Iowa Station by Mr. H. N. Grettenberg gave a result of 5.47 per cent of formaldehyde. The price of freezine is $1.00 per quart; $2.00 per half gallon, and $3.50 per gallon. The use of formaldehyde under the name of Freezine at $1.00 per quart for a five or six per cent solution when the forty per cent solution costs 40 to 50 cts. per pound is a very expensive manner of using this substance as a preservative.

The Dairy and Food Commision of Michigan, Hon. W. B. Snow, makes the following statements regarding the use of Freezine in Michigan:— "There can be no better place or time to again warn the milk dealers of Michigan that it is an open violation of law to use any preservative whatever in milk or cream, and to further advise them that the use of formaldehyde, sold as it is under the name of "Freezine" is injurious to health and makes them liable to heavy penalties.

All persons found using formaldehyde, boracic acid or other preservative in milk or cream sold for consumption in Michigan cities and villages will be vigorously prosecuted. No more nefarious practice can be employed than to threaten American child-life by the addition of poisonous acid preservatives to the food upon which nature intended young life to subsist."

From the results obtained in the analysis of substances intended for preserving food products, one can readily realize that common substances are placed upon the market in boxes and other packages branded with some term which tends to mislead the purchaser.

These terms are intended to give the impression that the contents of the package have an extraordinary power for preseving food products and at the same time the claim is made that they are harmless in every way. This condition may cause the purchaser to use large qualities of a substance of which he knows nothing, believing that it can do no harm to the person using the food product. The experience of the Aylesbury Dairy Company of London, in making 5,000,000 deliveries of milk without the use of preservatives and only 78 complaints about sourness, shows most decidedly that preservatives are not necessary. The use of preservatives, however, allows the charge to be made that their use is due to the lack of hygienic conditions connected with the production of the milk. In addition to the mixtures on the market for preserving food products in general, there are found those intended for preserving cider and fruit and other substances. The Preservaline Manufacturing Co. has a brand called "Cider and Fruit Preservative" and for which they make the following claims.

"Fruit Preservaline is made especially for use on Fruits, Berries, and Vegetables. It enables the busy housekeeper to put up fruits and vegetables without having to stand over a hot fire on a hot day, and without any loss, for the fruit thus prepared will not work or mould, and the life, flavor, and vitality will not be cooked out of it. It saves broken jars; food cooked away; time, labor and money. Preservaline is pure and healthy, and no objection can exist to its use."

The prices at which this substance is sold by the producers is for a single pound, $1.75, in 100 lb. lots and over, $1.00 per pound.

The substance proved to be salicylic acid when examined.

For preserving eggs a preparation called "E" is found upon the market prepared by the same company, who make the following claims for their product.

"Egg" Preservaline is made expressly and only for eggs. The best, cheapest and only effective method. Will keep eggs fresh one to two years. Eggs treated with "E" preservaline can be kept for a long time and will taste just as fresh when taken out of the solution as on the day when put in. Even if kept over a year in the solution the white and the yolk of the egg will be distinct, and can be separated exactly as in the freshest egg, and the egg can be cooked (boiled, etc.) the same as fresh eggs. The expense of preserving eggs with Preservaline is a mere trifle (about one cent for six dozen eggs), and is less each succeeding time, as the solution can be used until exhausted.

"Egg" Preservaline is the only truly reliable, practical and cheap preservative for eggs; moreover it is very simple to use."

A mixture of 40 per cent. of salt, 5 per cent. of borax and 45 per cent. of air slaked lime would represent the composition of this egg preserving substance. The mixture can be prepared by the would be purchaser at home at a much lower cost than 25 cts. per pound which is the price for which the substance is sold by the producer.

The remedy for those who produce thin cream and desire to deliver that which is thick to their patrons, is found under the brand "Cream Albuminoid." This substance is composed of 15 per cent. borax, 25 per cent. boric acid and 60 per cent. gelatine, and for which the producers claim "This new preparation, made on the highest scientific principles to give Cream that much-desired rich and heavy substance which it frequently lacks."

This substance is sold at the following prices,

Size "A" package, enough for 1 gallon thin Cream,.....$.25
" "B" " " " 5 " " " ..... .50
In bulk, $1.00 per pound.

The producers of preservatives for food products are so thoroughly interested in the welfare of the dairyman that they have prepared substances to be used as a disinfectant and for washing purposes under the name of "Ozaline" and "Hygos," mixtures of calcium carbonate, salt, etc., and soap, boric acid, and washing soda. The substances are sold at prices which vary from 15 cts. to 30 cts. per pound.

The use of preservatives in milk and other food products is a subject which should receive serious consideration from those producing and selling these products to the public.

The purchaser of any product has a right to receive the product in a pure condition and this is especially true when milk is used for children and invalids. Naturally in order that many substances may reach the market in good condition the hygienic conditions for the production of these products must receive careful attention by those who would make a success of their business.

Do not believe the statements which are made for any preserative, and, above all, do not use such substances in food products, thinking that they are harmless. Preservatives will not take the place of hygienic conditions in any manner or form and with proper care the use of such substances is not necessary in order that the product may reach the consumer in good condition.

SUMMARY.

I. The various brands of preservatives are composed of common substances such as boric acid and borax, salt, formaldehyde, etc. which can be prepared at a cost less than that charged for these substances under some other name.

II. The claims made by those selling mixtures for preserving food under meaningless terms are of no value and are misleading.

III. With proper care and by hygienic conditions connected with the production of Dairy and Food products, preservatives are unnecessary.

IV. The use of food preservatives are prohibited by many states and the use of such substances under some other name does not excuse the person using them.

Solutions for Testing Cream.

J. B. WEEMS. C. E. GRAY.

In the development of the dairy industry from the farm dairy to the creamery, it has been found that the processes connected with the industry must be controlled in an intelligent manner in order that success may result.

The study of cream-ripening has shown that the process must be understood if good butter is to be a constant product, and naturally with the demand for a means of controlling the ripening process, methods have ben developed for the purpose. In 1890 Dr. Mann proposed testing cream by using a tenth-normal solution of alkali and phenolphthalein as an indicator. Calculating the amount of lactic acid in the milk or cream from the amount of solution necessary to produce the pink color in the substance treated.

The demand for solutions so that the acidity could be determined has resulted in a number of preparations intended for this purpose being sold. The dealers in dairy supplies furnish what is regarded as a tenth-normal solution under the name of neutralizer. Tablets colored with phenolphthalien are sold to make solutions for the same purpose.

The alkaline tablets were introduced in this country by Prof. Farrington in 1894. In England, A. W. Stokes was granted a patent dated June 3, 1890, a part of which reads as follows: "In the case of milk 10 c. c. of the liquid is taken and the pellets contain .212 grams of hydrous sodium carbonate moistened with an alcohol solution of phenolphthalien. The number of pellets required to produce a permanent pink coloration gives at once the quantity of lactic acid in tenths of a per cent."

The demand for solutions for testing cream is constantly increasing and it was decided to test some of the tablets on the market intended for making solutions, for the benefit of the creameryman and the buttermaker.

The directions with each sample were to dissolve 24 tablets in 100 c. c. of water to a tenth of normal solution. The result obtained from solutions prepared according to the directions were as follows:

Sample 1.

(a) 24 tablets, weighing 8.9705 grams were dissolved in 100 c. c. of water, and gave a solution equal to 114.8 c. c. of a tenth normal solution.

(b) 24 tablets, weighing 8.9770 were dissolved in 100 c. c. of water and gave a solution equal to 114.8 c. c. of a tenth normal solution.

Sample 2.

(a) 24 tablets weighing 8.9692 grams were dissolved in 100 c. c. of water and gave a solution equal to 112.4 c. c. of a tenth normal solution.

(b) 24 tablets weighing 8,9920 grams were dissolved in 100 c. c. of water and gave a solution equal to 112.8 c. c. of a tenth normal solution. These results show that the tablets in Sample 1 when made into a solution according to the directions for a tenth normal solution was 14.8 per cent. stronger and the tablets of Sample 2 gave a solution 12.4 per cent. to 12.8 per cent. stronger than a tenth normal solution.

The effect of exposure and the keeping qualities of the tablets have an important bearing on their use in the creamery.

The tablets under examination were exposed from May 18th to Nov. 30th. With sample No. 1 it was found that after exposure that 24 tablets dissolved in 100 c. c. of water produced a solution which was equal to 105 c. c. of a standard tenth normal solution, and sample No. 2 gave a solution under the same condition equal to 102.9 c. c. of a standard tenth normal solution. The coloring matter or indicator had largely disappeared as the result of the exposure of the tablets.

THE EFFECT OF FREEZING STANDARD SOLUTIONS.

The question is sometimes asked in regarding the effect of freezing and exposure on tenth normal solutions and in connection with the subject the following experiments may be of interest to those connected with creameries. Five bottles filled with a tenth normal solution were allowed to freeze and then to thaw. The freezing and thawing were repeated three times and the solution tested, care being taken to titrate at the same temperature at which the first tritration was made. The results showed that no change had taken place in the solution. If a solution has been frozen it must be completely thawed be-

ore using for testing cream. The solution in a bottle containing a quantity of ice is stronger than the original solution as may be shown by the following experiments.

1. A bottle containing 2000 c. c. of a tenth normal solution was partly thawed. The liquid part measured 750 c. c. and 100 c. c. of the solution was equal to 154.4 of a standard tenth normal solution while the ice remaining in the bottle measured 1250 c. c. when melted, was much weaker, as 100 c. c. of this part of the solution was only equal to 61.6 of a tenth normal solution.

2. A second experiment in which 2000 c. c. of the tenth normal solution was used gave 1350 c. c. of liquid and 650 c. c. from the ice when thawed. The solution poured from the bottle was of such strength that 100 c. c. was equal to 134.8 c. c. of a tenth normal solution while the ice when melted gave a solution of 100 c. c. equal to 32 c. c. of a tenth normal solution.

3. Another experiment using 2000 c. c. of a tenth normal solution, there was poured off 650 c. c. of liquid when partly thawed; 100 c. c. of this solution was equal to 191.6 c. c. of a tenth normal solution and the frozen part when thawed measured 1350 c. c. and was of such a strength that 100 c. c. was equal to 44.8 of a tenth normal solution.

From these results it is readily seen that if the liquid portion of a partly frozen soluton is used to determine the acidity of a sample of cream or milk, the results will be misleading and of little value. The solutions which have been frozen must be completely thawed before using them in making a determination of acid in milk or cream.

THE EFFECT OF EXPOSURE ON STANDARD SOLUTIONS.

The effect of exposure on solutions used in the creamery is one of interest. The question may be considered from two points of view, the effect in an open bottle and when exposed in an open vessel.

In the experiments about 500 c. c. of a tenth normal solution was placed in a 2000 c. c. bottle and the glass stopper placed in it. No change was was found to have taken place in the solution on standing.

The same quantity placed in a bottle of the size as given

above, but without the stopper, gave as a result a loss of strength of 3.6 c. c. in 100 c. c. of the solution, after nine days exposure.

When a solution is placed in an open vessel it loses its strength more rapidly than in a bottle. This change may be seen from the following results:—

	Strength in c. c. of tenth normal acid.
Strength of 100 c. c. of solution when placed in vessel	100 c. c.
Strength of 100 c. c. of solution after 1 day's exposure	95.2 c. c.
Strength of 100 c. c. of solution after 3 " "	83 2 c. c.
Strength of 100 c. c. of solution after 5 " "	66.4 c. c.

The results indicate that a small quantity of solution in a bottle does not tend to lose its strength, if the stopper is placed in the bottle. A solution in open bottle, on the other hand, loses its strength gradually. A solution should not under any circumstances be allowed to remain in an open vessel as the change is very rapid. The change in the solution is produced by the absorption of carbon dioxide by the potassium hydrate, resulting in the formation of potassium hydrogen carbonate as may be shown by the chemical equation

$$KOH + CO^2 = KHCO^3$$

potassium hydrate — carbon dioxide — potassium hydrogen carbonate

The resulting compound having an acid reaction, the indicator naturally causes the solution to lose its strength when tested under the usual conditions.

SOLUTIONS OF CALCIUM HYDRATE, LIME WATER.

The suggestion has been made many times that a solution of calcium hydrate could be readily prepared by the butter maker. Calcium hydrate or lime is only dissolved by water to a limited extent. The quantity of lime which water will dissolve is quite constant as may be seen from the following table given by Dammer.

Temperature	One part lime (CaO) will dissolve in parts of water as follows
32 °F	[illegible] 759.
50 "	770.
60 "	791.
86 "	862.
113 "	975.

If the amount of lime which is dissolved is constant in a practical sense it would naturally follow that a solution of definite strength would result if water was allowed to dissolve the lime for a certain time and by pouring off or decanting, the resulting solution would be suitable for testing cream.

To test the value of the use of solution of lime water for creamery purposes the following experiments were made.

(1) Nearly two ounces (50 grams) of pure lime were placed in 2 quarts of water (2000 c. c.) and allowed to stand for sometime at a temperature of 68°F(20°C). The clear solution was poured off and the strength tested. 100 c. c. of the solution was as strong as 44 c. c. of a tenth normal solution.

(2) The same quantity of lime and water was used as in 1, but the temperature of the water was 86°F.(30°C). The clear solution contained sufficient lime when tested that 100 c. c. was equal to 43.6 of a tenth normal solution.

(2) The same quantity of lime and water was used as in No. 2 with a temperature of 104°F(40°C)., giving a solution having a strength of 100 c. c. equal to 41.6 c. c. of a tenth normal solution.

The solutions obtained in the above experiments were allowed to cool and well shaken up with the lime remaining in the bottle, at ordinary temperature (66°F) and the strength of the clear solution tested. The resulting solutions from the three experiments had the same strength; 100 c. c. being equal to 45.2 c. c. of a tenth normal solution. The results show that a difference of 36°F(20°C) in the temperature of the water used for dissolving the lime causes a loss in strength of 100 c. c. of the lime water (calcium hydrate) equal to 2.4 c. c. of a tenth normal solution. The strength of the lime water after shaking in the presenc of lime at ordinary temperature was about one-half of a ten normal solution or more correctly, .45 as strong. Common lime used in place of the pure material gave practically the same results. The pure substance is preferred to the common as being the less liable to contain impurities.

SOME SUGGESTIONS ON THE USE OF NORMAL SOLUTIONS IN THE CREAMERY.

A normal solution must be accurate in order to obtain results of value, and care must be used in order that the solution may remain so. Exposure will cause the solution to become weak and worthless. The ordinary methods of using the solutions, such as the open burette and pouring the solution into this burette every time a determination is to be made is not the best manner of using such solutions. The solution is not only exposed but a large part of the solution is sometimes lost by pouring on the outside of the burette. To prevent the loss and exposeure it is better to use a bottle for the solution which has the burette attached by means of a clamp to the bottle and the top of the burette so connected with the bottle that the solution can be drawn from the bottle into the burette. A rubber tube connected with the top of the burette enables one by placing the tube in the mouth and drawing the air, to cause the solution to flow from the bottle into the burette. With care the amount of the solution need be only slightly over the 0 mark. This excess can be readily withdrawn in the usual manner by means of the valve. Burettes and bottles fitted as described are sold by dealers in chemical supplies, or can be made by one who has had some experience in handling glass tubing.

The solution of phenolphthalein used as an indicator is readily prepared.

Phenolphthalein is a powder and to prepare the substance for use as an indicator, 1 part (1 gram) is dissolved in 100 parts of alcohol (100 c. c.). Use six or eight drops of the indicator (.5 c. c.) for the determination of the acidity of milk, or cream. The phenolphthalein in the form of a powder may be purchased from any dealer in chemical supplies for about 50 cts. per ounce. A deci or tenth normal solution is one tenth as strong as a normal solution and for those who may desire to make the solution the following suggestion may be of interest. The price of the normal solution is the same as for a tenth normal solution. To prepare a tenth normal solution from a normal solution take 100 c. c. of a normal solution and add to it 900 c. c. of distilled water. If two graduated measuring flasks are provided, one of 100 c. c., the other of 1000

c. c. capacity, the tenth normal solution can be readily prepared by filling the 100 c. c. flask (the flask should be dry before filling with the solution) with the normal solution of potassium hydroxide to the mark; pour this into the 1000 c. c. flask which has been washed with distilled water, wash out the 100 c. c. flask with small quantities of distilled water and add the washings each time to the contents of the 1000 c. c. flask. Add distilled water to the 1000 c. c. flask until the mark is reached. Shake well and transfer to the bottle containing the tenth normal solution. It is readily seen that by this means a tenth normal solution can be prepared at a reasonable price for use in creamery work. The two flasks will cost less than $2.00 and can be obtained from any dealer in chemical supplies.

There is an opportunity at the present time for some one to prepare and place on the market large tablets containing a quantity of sodium carbonate sufficient to prepare 1000 c. c. of a tenth normal solution. These tablets should not be colored with the indicator as there is a tendency for the indicator to fade and become useless. For explanation of the normal solutions and how they may be used in creamery work those interested are referred the work "Testing Milk" by Professors Farrington and Woll, which contains many suggestions for practical work.

SUMMARY.

I. The freezing of a solution does not injure the strength of the solution.

II. A frozen solution must be completely thawed before using.

III. Exposure of a solution in an open vessel will decrease its strength.

IV. Lime water furnishes a solution slightly less than one-half the strength of a tenth normal solution.

V. The solution used in the creamery should be kept in suitable bottles with the burette connected so that the solution is not exposed and wasted.

VI. Tenth normal solutions can be readily prepared from normal solutions if the creameryman has suitable measuring flasks. The cost of the solution may be reduced to one-fifth or one-tenth of the usual price.